Albuquerque Operations Office
Unaddressed Technology Needs

Amarillo Area Office (Pantex)

High Explosives/VOCs/SVOCs In Situ Biodegradation Project (AL-07-06-03-SC)

About 40,000 cubic yards of soil around and beneath the two high explosive fabrication facilities are contaminated with high explosives (HE) (e.g., RDX, TNT, TNB, and HMX), VOCs, and SVOCs. The contamination extends to subsurface depths of 100 ft. Preliminary studies indicate the contaminated soils are point sources, but proximity to operation facilities, utilities, and depth of contamination preclude excavation as a remediation alternative. Additional similar sites are located at the Pantex Plant as well as at most other DOE, DoD, and commercial HE processing facilities. An in situ method to treat the HE, VOCs, and SVOCs is needed. Biodegradation of HE has been demonstrated in ex situ applications. Recent composting demonstrations at Pantex also have demonstrated the potential for biodegradation of HE. Characterization data at Pantex indicate that HE degradation may be occurring in situ. Biodegradation of SVOCs, and VOCs in situ in soils has been demonstrated under varying conditions at numerous sites. An in situ treatment technology that will address both the HE and organic contamination is also needed. An identification and understanding of ongoing in situ HE processes and limiting factors is needed. This information could then be used to develop and demonstrate enhanced biodegradation of HE. Preliminary data indicate that HMX degradation may be occurring anaerobically. Considering the occurrence of HE and HE degradation products and VOCs and SVOCs, the treatment technology must consider the potential for creating more mobile and toxic byproducts. A complete understanding of the specific contaminant mobility and degradation products is needed to apply the in situ treatment that best meets the performance objectives.

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High Explosives (HE) & Barium (Ba) Remediation Of Soils, Surface Water And Groundwater (AL-07-01-01-SC)

HE & Ba at LANL TA-16 require cleanup to negotiated levels. Waste volumes are currently unknown, but are greater than 2,000 cubic yards (estimate 6 potential release sites (PRS) would benefit). Surface soils are contaminated with HE up to > 20 wt % - including HE chunks. Barium up to 30 000 ppm is associated with HE. Surface and groundwater are contaminated at levels > MCLs. At this time, incineration of contaminated soils means shipment to an off-site, out of state facility. This method is prohibitively expensive, especially when cleanup budgets are declining significantly. Pump-and-treat is not a viable option in a situation where there is not an existing ground water body, but a perched aquifer consisting of discontinuous saturated zones. In addition, the pump and treat method is a long-term, expensive option (an estimated $6 million for this site alone) which would not suit the need for cleanup of all Los Alamos sites by 2005.

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In Situ Remediation/Immobilization of Landfill Materials (AL-07-06-04-SC)

Landfill #3 is contaminated with HE (15,000 ppm RDX) and may be a point source for HE contamination in the perched aquifer underlying the Pantex Plant. The landfill was used primarily for construction debris and disposal of sediments that were removed from ditches in the area. These ditches are known to have carried stormwater runoff as well as industrial process waters contaminated with HE. The landfill is approximately 218 ft wide, 1,700 ft long, and 7 ft deep, and contains about 95,130 cubic yards of material. The burning grounds landfill is contaminated with HE, barium (340,000 ppm), and toluene (3,330 ppm). The barium source is thought to be from disposal of ash from historic burning of barium nitrate used in mock explosives and as a binding agent for explosives. Water-soluble and acid-soluble barium compounds are toxic. Levels of contaminants beneath and surrounding both landfills exceed Texas Risk Reduction Standards and may require RRS 3 closure. Remediation technologies are currently being reviewed to determine if there is an environmentally safe and cost-effective alternative to excavation/capping the landfill. A technology is needed that can remove the organics (HE and toluene) and also immobilize the soluble forms of the barium. The barium compounds may require immobilization prior to the remediation of the organic materials. Due to the soil chemistry, low concentrations of barium nitrate and barium oxides have been found to convert to the relatively insoluble barium sulfate. A technology is needed that can address the in situ remediation of HE, barium, and toluene in a landfill setting. The technology must address the issue of heterogenous fill and debris and the monitoring requirements to demonstrate cost-effective remediation. A treatment that first converts the barium oxides to barium sulfate followed by either enhanced biodegradation of either or both of the HE and toluene contaminants appears promising. The enhanced biodegradation process may require both anaerobic and aerobic processes to degrade both the HE and toluene.

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In Situ Biobarrier for Contaminated Groundwater (AL-07-06-02-SC)

Evaluate, develop, and utilize in situ biobarrier for the containment and treatment of organic and inorganic contaminated groundwater. The technology must be cost efficient and meet project goals. High explosives (RDX, 1,35-TNB, and HMX) and organic compounds (TCE, 1,2-DCE) are present in the perched groundwater aquifer underlying Zone 12 at Pantex Plant that are migrating offsite. The contamination sources include: a system of playas and ditches in and around Zone 12, and migration of contaminants released from activities outside of Zone 12. The perched aquifer at the plant boundary follows a channel feature. Conventional pump-and-treat of offsite contamination may be impractical due to the shallow saturated thickness. A barrier system would reduce offsite migration and improve site boundary pump-and-treat efficiency. A potential alternative technology to conventional pump-and-treat systems is development and implementation of a biobarrier. The biobarrier would supplement the pump-and-treat system. Because of the variety of contaminants present and relatively low concentrations of contaminants, a suite of potential microbes or other biologic agents require enhancement to provide an effective technology for contaminant containment and reduction. The installation of injection points (wells) for addition of nutrients to the perched groundwater system and demonstration of in situ microbial treatment and enhanced recovery of contaminants through the existing pump-and-treat system utilizing a biobarrier is needed.

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Decontamination and Decommissioning (D&D) Technology Development (AL-07-06-01-DD)

Three hundred surplus Pantex Plant facilities are scheduled for D&D over a 20-year period, pending availability of funding, including cleanup of facilities contaminated with HE. Several factors increase the difficulty of characterization and D&D of Pantex Plant fabrications. Facilities are usually characterized by large and complex surfaces (e.g., piping, process equipment, structural steel, sinks and drains, and ventilation ducts). The distribution of contaminants over the surface is highly variable (i.e., the mean concentration throughout the facility is low because there are many isolated locations hot spots with very high concentrations). Many materials are used in the structures and some of the materials tend to absorb contaminants (e.g., brick, cinder block, concrete, and wood). Rapid field characterization methods are needed to allow location of hot spots and cost-effective cleanup methods are needed to decontaminate structural materials without generating excessive volumes of hazardous residuals. Detection methods such as portable gas chromatograph should be demonstrated for HE detection on building materials. Spot decontamination could then be performed using conventional removal and treatment or advanced technologies such as hot gas decontamination, radical-initiated decomposition, base-initiated decomposition, water jet systems, atmospheric plasma jet, and chemical extraction using a solvent (e.g., acetone).

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Grand Junction Office

Long-Term Ecology of UMTRA Landfill Covers (AL-07-09-03-SC)

Within a few years, deep-rooted vegetation has been established on several UMTRA disposal cells, rooting through compacted soil layers and, in some cases, into buried tailings. Some research indicates that biological intrusion of landfill covers may increase water infiltration, radon flux, and biological transport of contaminants. For this reason, the Long-term Surveillance and Maintenance (LTSM) program at GJO has initiated regular herbicide applications to suppress plant growth and that such control measures will likely be required for the design life of the disposal cell. The regulatory design life is 200 to 1,000 years, but GJO recognizes the impracticality of committing herbicide spraying program of that duration. LTSM needs reliable evaluations of possible consequences of biointrusion, and ecological development in general, on UMTRA landfill covers as a basis for long-term performance and risk assessments and reasonable vegetation management strategies. LTSM will eventually monitor 24 Title I uranium mill tailings disposal facilities and numerous other radioactive and hazardous materials landfills across the country. Monitoring currently involves sampling down-gradient ground water wells: elevated contaminant concentrations would indicate leakage from the disposal facility. LTSM require post-closure methods for monitoring infiltration and leakage well in advance of contaminant dispersion to down-gradient wells wit potential for costly remedial action. Under the UMTRA Groundwater Program, if failure of a disposal cell cover occurs because of biointrusion, groundwater clean-up activities will have little long-term value.

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Characterization of Excess Legacy Material - Weapons Component Testing (AL-07-02-05-MW)

Identification of radionuclides and RCRA constituents in excess legacy material associated with weapons component testing. Weapon component destructive testing items need to be characterized for potential disposition possibilities and for demilitarization and sanitization.

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Hydrologic Performance Monitoring of Engineered Covers (AL-07-09-01-SC)

Three Grand Junction Office (GJO) programs involve isolation of radioactive and other hazardous materials in landfills: Long-Term Surveillance and Maintenance (LTSM), Uranium Mill Tailings Remedial Action - Ground Water (UMTRA-GW), and the Monticello Remedial Action Program (MRAP). The success of all three programs rely on the performance of engineered covers which have already been constructed or are being constructed. Efficient and preferably non-destructive methods are needed for monitoring the hydrologic performance of compacted soil layers and capillary barriers in both existing and planned landfill covers. LTSM will eventually monitor 24 Title I uranium mill tailings disposal facilities and numerous other radioactive and hazardous materials landfills across the country. Monitoring currently involves sampling down-gradient ground water wells: wherein elevated contaminant concentrations would indicate leakage from the disposal facility. LTSM require post-closure methods for monitoring infiltration and leakage well in advance of contaminant dispersion to down-gradient wells which may require costly remedial action. UMTRA-GW is in the process of evaluating the need for clean up of radioactive and other hazardous materials in ground water at the 24 Title I sites. The program is moving forward under the assumption that the source of groundwater contamination, uranium mill tailings, has been contained in disposal cells. There is a need to detect a failure of a disposal cell cover to control contaminant seepage otherwise, groundwater clean-up activities may have little long-term value. MRAP will construct an alternative landfill cover at the Monticello, Utah, Superfund site during 1998 and 1999. The cover design relies, in part, on a water balance system: soil water storage enhanced by a capillary barrier and evapotranspiration to control water infiltration. The Environmental Protection Agency (EPA) requires inclusion of a geomembrane and a compacted soil layer in the design, at considerable cost, to demonstrate equivalency with EPA's RCRA Subtitle C guidance. Successful monitoring and demonstration of the performance of the MRAP water balance cover may preclude costly design redundancies in future applications of the water balance system at other Department of Energy (DOE) facilities.

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Kansas City Area Office

Non-Intrusive Removal of Polychlorinated Biphenols (PCBs) from Soil Both Above and Below the Water Table Underneath Buildings (AL-07-04-01-SC)

Large concentrations of PCBs are contaminating the soil beneath the Main Manufacturing Building at the Kansas City Plant. The building is a three million square foot manufacturing building used for the production of non-nuclear parts for nuclear weapons. This is an ongoing mission of the KCP and disruption of this mission could affect national security. Currently, no technology exists to meet this need.

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Kirtland Area Office (Sandia)

Hot Cell or Similar Device for Remote-Handled Mixed Waste (AL-07-02-07-MW)

A hot cell in a Resource Conservation and Recovery Act (RCRA)-permitted facility. SNL/NM has a number of large waste-like items stored in the Manzano Bunkers on Kirtland Air Force Base. There are also a number of remotely-handled waste items associated with past activities in Technical Area V, including mixed TRU Waste. Many of these wastes or waste-like items require disassembly, characterization, and treatment in order to achieve off-site disposal. Progress towards treatment and disposal is hampered by an absence of a facility to handle these wastes.

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Los Alamos Area Office

Mixed Waste Treatment (AL-07-01-09-MW)

Mixed waste treatment - water reactive compounds. Los Alamos has 78 items, comprising 6.0 cubic meters of water-reactive compounds, principally lithium hydride, requiring treatment. Radionuclides are mainly depleted uranium; levels unknown. No commercial waste treatment is available for water reactives. DOE-owned treatment for water reactives is specifically designed for metallic sodium and cannot accept lithium hydride. Method must treat to Land Disposal Restrictions (LDR) standards. All waste streams are cited in the Los Alamos Site Treatment Plan (STP) and are subject to compliance order milestones. The treatment technology must be capable of reacting LiH in controlled conditions, containing the uranium residuals, and venting the residual hydrogen gas. For one particular technology, the detailed design for a mobile treatment system is complete.

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Remediation of 25 Material Disposal Areas (MDAs) (AL-07-01-02-MW)

Twenty-five Material Disposal Areas (MDAs), which encompass a total of 108.6 acres, contain contaminated debris, soils, metals, liquids, plutonium, americium, uranium, cesium, gas cylinders and hazardous materials. 1,000 Ci inventories. Some areas contain pits and shafts excavated into the tuff. Depth to groundwater is approximately 800 ft. Migration from MDAs into the soil and tuff below has occurred. Among these 25 MDAs there are complex landfills which have not yet been characterized and because of the high cost and complexity of characterization, have been targeted for cleanup during outlying years. From archival records, indications are that many have a variety of radiological, toxic and hazardous chemicals, as well as gaseous constituents that may be difficult and not without risk to clean up. It may be that the best solution will be to stabilize those areas with regulation-approved covers, and emplace monitoring and surveillance equipment. However, other methods (non-invasive) to identify what is in the more complex material disposal areas could potentially save millions of dollars. Stabilization of variously sized MDAs, some of which are close to residential and commercial areas. Need cost-effective barrier technologies, capping technology, and reliable long term surveillance monitoring. Various reduction in concentrations of contaminants, most of which are not known at this time. Some areas have not yet been characterized to confirm archival data and are known to have a variety of radiological, toxic and hazardous contaminants.

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Contamination Plumes in Soil and Tuff (AL-07-01-03-SC)

Cost-effective remediation of plumes in soils and tuff. There are a number of disposal areas that have been identified as having plumes of tritium vapor, volatile organic compounds, and chlorinated hydrocarbons in soils and tuff. Conventional treatments such as pump-and-treat are long-term and expensive. The following is characteristic of numerous sites at the Laboratory. Area L, which is part of the waste disposal area at Technical Area 54, contains mostly chlorinated solvents. The dimension of the plume is approximately 1475 by 300 feet. Highest contaminant concentrations are found between 120-180 feet, and decrease quickly with depth. There are no perched aquifers that have been identified at Technical Area 54; and groundwater is 960 feet beneath the surface. Therefore, conventional groundwater pump and treat technology is not applicable. A pilot extraction study is evaluating both passive and active extractions for remediation alternatives. This is important in view of the fact that there is a possibility of releases from old shafts which represent a continuing source term of disposed organic chemicals.

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Cost-Effective Mechanism For Stabilization (AL-07-01-15-MW)

Stabilization of large landfill in place, including stabilization of steep canyon sides; prevention of off-gassing of organic vapors. The airport landfill was the original landfill for Los Alamos and received large quantities of domestic waste as well as large quantities of industrial waste. It occupies about 40 acres. The landfill currently occupies mesa top and canyon edge at the local airport. Debris protrudes from the edge and the cover has subsided in various places. Depth to groundwater is about 800 ft. Methane, contaminated soils, debris, metal, concrete, volatile and semi-volatile organic compounds, PCBs, and uranium have been detected.

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